PATENT SPECIFICATION

DRAWINGS ATTACHED

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COMPLETE SPECIFICATION

Improvements in and relating to Positive Displacement Hydraulic Pumps and Motors

We, ROBERT BOSCH G.M.B.H., a German Company, of 4, Breitscheidstrasse, Stuttgart-W, Germany, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to a positive displacement hydraulic pump or motor comprising a casing which is closed by a cover and has two parallel bores in which two positive displacement elements are rotatable for positively displacing fluid or positive displacement by fluid, and which contain bearing bushes journalling shafts of the displacement elements and lying against the side faces of the displacement elements.

It is known in such machines to provide a space between the cover of the casing and the opposing faces of the bearing bushes in which space sealing rings are provided, said rings sealing any spaces subjected to different pressures between the cover and the other parts of the machine. With these known constructions, however, the disadvantage occurs that both the bores in the machine casing and also the axial lengths of the bearing bushes and displacement elements must have only comparatively small tolerances. If, with regard to pumps, the bearing bushes and the displacement elements in the pump casing are held together only by the cover, then, in the event of excessive tolerances, either the displacement elements and bearing bushes are pressed together too tightly by the cover, leading to excessive friction on the faces between the bearing bushes and the displacement elements which greatly impairs the output of the pump and can even lead to jamming of the parts thereof, or the bearing bushes and displacement elements may have so much play that they can be no longer kept in the necessary position by the cover, in which case fluid being pumped flows between the faces of the displacement elements and the bearing bushes back from the high pressure to the low pressure side of the pump, whereby the output of the pump is also reduced. If sealing rings are inserted between the bearing bushes and the casing, it may also easily happen that either there is not enough space for the sealing rings or the space between the cover and bearing bushes is so large that the sealing rings are not sufficient to seal the corresponding spaces in the desired manner. Parts with small tolerances are more difficult to manufacture, however, and are therefore more expensive.

In accordance with the present invention, at least one substantially rigid distance piece is disposed between the cover and the adjacent bearing bush face and forming one side of a hydraulic pressure zone located between the cover and the adjacent bearing bush.

This distance piece which can be manufactured in various stock thicknesses permits greater manufacturing tolerances of the individual parts and consequently cheaper manufacture of said parts. Moreover, by the selection of a distance piece of the right thickness, the pump or motor can be more rapidly assembled. There is also the additional fact that this ensures correct action when the hydraulic pressure zone is formed between the distance piece and the adjacent bearing bush face and a sealing ring bounding the pressure zone is inserted between the bearing bush and the distance piece.

The invention will be further described, by way of example, with reference to the accompanying drawings which illustrate one embodiment of the invention as applied to a gear pump or motor and in which:—

Fig. 1 is a longitudinal section through a gear pump or motor; and

Fig. 2 is a cross-section along the line II—II of Fig. 1.

Referring to the drawings, a casing 1 of a gear pump or motor has two parallel blind bores 2, 2^1 which intersect or overlap in the zone 3. These bores 2, 2^1 receive, with a slid-

ing fit, two spectacle-shaped bearing members or bushes 4, 4¹, the bores of which receive the shafts 5 and 6, respectively, of two meshing gears 7 and 8, serving as fluid-displacement elements for positively displacing fluid (in the case of a pump) or positive displacement for fluid (in the case of a motor). The bearing bushes 4, 4¹ are located for axial displacement in the respective bores 2, 2¹. A closure cover 9 of the casing 1 has an annular projection 10 which slides into said bore 2. The projection 10 stops short or is interrupted in the region of the bore 21 so that a free space is formed in this region. In this space, a distance piece 11, is fitted. The shaft 5 extends through a bore 12 of cover 9 and is sealed therein by means of a sealing ring 13 which is fitted into the bore 12 from the inside of the cover and rests against a shoulder 12¹ formed by a reduction in diameter of the bore 12. The outer periphery of this sealing ring 13 is shaped to form an elastic sleeve 14, the inner surface of which rests against an angled, metal stiffener ring 15, whilst its outer surface is pressed against the wall of a slightly reduced section 16 of bore 12. A resilient lip of the sealing ring 13 contacts the shaft 5.

Said distance piece 11 is a substantially plane and parallel plate of rectangular cross-section. On its opposite longitudinal sides 17, 17¹ there are provided respective recesses 18, 18¹ for receiving corresponding portions of the shafts 5 and 6. To enable the distance piece 11 to engage into the recess formed by the interruption of the centering projection 10, its corners are rounded off to form arcuate faces 19 of identical radii. Adjacent to these arcuate faces 19, the distance piece 11 has at each end inwardly directed faces 21 which coincide with the bores 2, 2¹. These spaces 21 are joined by a part cylindrical intermediate section 22 which fits into a correspondingly machined part 22¹ of the casing 1. Due to its lateral side surfaces 19, 21, 22, the shape of which conform to the bores 2, 22¹, 2¹ of the casing 1, the distance piece 11 is located in casing 1 so that it cannot be rotatably displaced.

The thickness of the distance piece 11 is so chosen as to compensate for differences in the tolerances between the depth of bores 2, 2¹ and the axial lengths of the bearing bushes 4, 4¹ and the gears 7 and 8, thus enabling longitudinal movement of the bearing bush 4¹, necessary for the operation of the pump or motor, whilst preventing a larger longitudinal displacement between the bush 4¹ and the cover 9. In order to obtain a speedy equalization of these tolerances during the assembly of the pump or motor, the distance piece 11 can be produced and stored in various degrees of thickness.

In a groove, having approximately the shape of a figure '8' and formed in the centre of the front face 23 of the bearing bush 4¹, there is fitted an O-ring 25, which seals a hydraulic pressure zone 26 at the front face 23 of the bearing bush 4¹ against the adjacent face 27 of the distance piece 11, and thus also against the space between the cover 9 and the other parts of the pump or motor. This pressure zone 26 is connected by a passage 28, located within the bearing bush 4¹, with the delivery chamber of the pump or motor. The pressure applied in this manner and prevailing in the pressure zone causes a firm connection between the bearing bushes and the gears during operation of the pump or motor.

A sealing ring 29 is located in a groove formed in the cover supporting face 30 of the casing 1, and forms a seal between the casing and the cover 9. The assembly of the pump or motor just described is very simple and can be achieved as follows:

After the insertion of the gears 7, 8 and the corresponding bearing bushes 4, 4¹ into the casing 1, and of the sealing ring 29, the O-ring 25 is fitted into its groove in the front face 23 of the bearing bush 4¹, and then the distance piece 11 is fitted thereover. This distance piece is self-aligning, because its eccentric ends will only fit into the correspondingly machined parts 22¹ of the casing 1. The distance piece 11 is selected, during the assembly, in accordance with the thickness required and so that, with the given axial differences of the parts of the pump or motor, the O-ring 25 projecting from its groove is suitably compressed so that it urges the bearing bushes against the gears, even if the pump or motor is not under pressure, whilst at the same time maintaining the free axial movement, that is, the "floating" action of bearing bush 4¹.

Then the cover 9 into the bore 16 of which the sealing ring 13 has been fitted, is pushed over the gear shaft 5, causing the centering projection 10 to engage into bore 2 of casing 1. The cover 9 is thus centred in the correct position relative to casing 1 and can be screwed down without any further difficulty.

The distance piece 11 may be secured against rotation by any other means; for example, by recesses formed in its lateral sides for engagement with pins which have been additionally fitted in the casing.

The invention may also be applied to pumps or motors, in which the spectacle-shaped bearing bushes 4, 4¹ are replaced by individual bushes for the shafts.

It is to be understood that although the invention has been described in detail in connection with its application to gear pumps or motors, it is also applicable to other forms of positive displacement hydraulic pumps or motors employing two displacement elements.

WHAT WE CLAIM IS:—

1. A hydraulic pump or motor comprising a casing which is closed by a cover and has

two parallel bores in which two positive displacement elements are rotatable for positively displacing fluid or positive displacement by fluid, and which contain bearing bushes journalling shafts of the displacement elements and lying against the side faces of the displacement elements, at least one substantially rigid distance piece being disposed between the cover and the adjacent bearing bush face and forming one side of a hydraulic pressure zone located between the cover and the adjacent bearing bush.

2. A hydraulic pump or motor as claimed in claim 1, in which said distance piece is positively located against rotational displacement.

3. A hydraulic pump or motor as claimed in claim 1 or 2 wherein said hydraulic pressure zone is formed between the face of the bearing bush facing the cover and the distance piece and is bounded by a resilient seal.

4. A hydraulic pump or motor as claimed in claim 1, 2 or 3 in which said cover is located by a projection thereon which engages with a sliding fit into at least one of the bores for the bearing bushes.

5. A hydraulic pump or motor as claimed in claim 4, in which the shaft connected to the driven or driving fluid-displacement elements extends through the cover and in which the locating projection of the cover engages only into the bore housing the driven or driving fluid-displacement element.

6. A hydraulic pump or motor as claimed in claim 5, in which the said shaft is sealed to the cover by means of a sealing ring which compensates for a limited amount of radial play.

7. A hydraulic pump or motor as claimed in claim 4, 5 or 6, in which the bores for the fluid-displacement elements partly overlap one another and in which the locating projection extends substantially around that part of the circumference of a bore not overlapped by the other bore.

8. A hydraulic pump or motor constructed and arranged substantially as herein described with reference to and as illustrated in the accompanying drawings.

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914616 COMPLETE SPECIFICATION

1 SHEET *This drawing is a reproduction of the Original on a reduced scale*

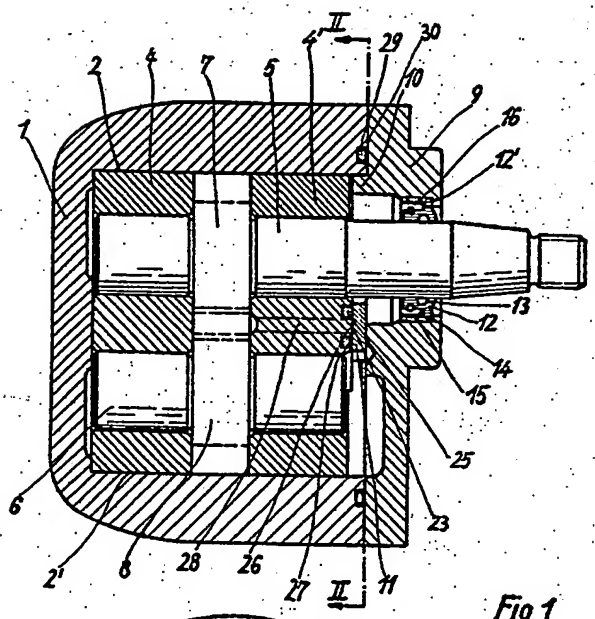

Fig.1

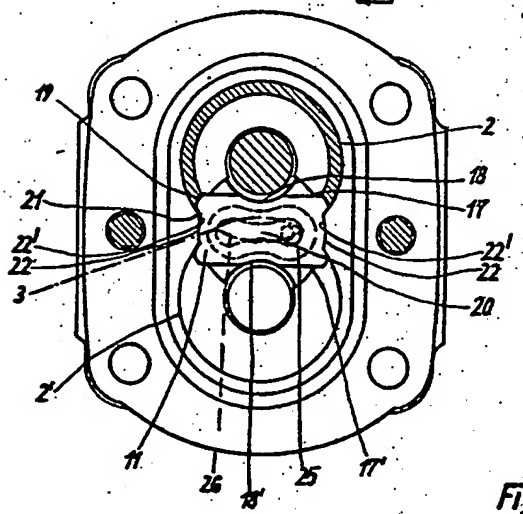

Fig.2